REMARKS

The objection to the reference numeral on page 14 of the specification was corrected.

Claim 8 was revised by incorporating the feature of claim 9 and the features that the electric discharge tube is inserted into and fixed to the axial hole at one end thereof, that the other end thereof protrudes from the axial hole, and that the cylindrical space extends in the axial direction at an arbitrary length such that the cylindrical space does not reach the one end face of the outside conductor. The additional feature of the electric discharge tube is clearly described in Fig. 1 and the additional feature of the cylindrical space is clearly described in the specification at page 8, line 22 through page 9, line 3 and Fig. 1.

In addition, claim 10 was revised by incorporating the feature of claim 11.

In order to make it clear that the recited outside conductor refers to the cylindrical outside conductor, "the outside conductor of the coaxial cable" was changed to "the outer conductor of the coaxial cable".

Applicants respectfully submit that claims 10, 12, 13 and 15 are allowable in view of the Examiner's indication that the pending claims 11 and 13 would be allowable if rewritten in independent form, including all of the limitations of the base claim and any intervening claims.

As for the patentability of the amended claims 8 and 14, the invention, as claimed in claim 8, is directed to a coaxial microwave plasma torch, comprising: a solid cylindrical outside conductor; a cylindrical electric discharge tube inserted into and fixed to an axial hole at one end thereof, the axial hole being formed on one end face of the outside conductor, the other end of the electric discharge tube protruding from the axial hole; and a coaxial cable for microwave transmission at one end thereof to the other end face of the outside conductor from outside. An antenna is electrically connected to an inner conductor of the coaxial cable at the one end of the

coaxial cable. A through-hole is formed in the outside conductor in such a way that the through-hole extends in the axial direction from the other end face of the outside conductor toward the axial hole. The antenna is electrically insulated from the outside conductor and extends into the electric discharge tube along the axial direction through the through-hole. An outer conductor of the coaxial cable is electrically connected to the outside conductor, and a gas inlet pipeline for supplying gas into the electric discharge tube is provided in the outside conductor. A cylindrical space is formed between a peripheral surface of the axial hole of the outside conductor and an outer surface of the electric discharge tube. The cylindrical space has a predetermined radial length and extends in an axial direction from the bottom face of the axial hole at an arbitrary length such that the cylindrical space does not reach the one end face of the outside conductor.

U.S. Patent No. 5,053,678 to Koike, et al. discloses a microwave ion source comprising a microwave generator (1), a coaxial line (2), another coaxial line constituted by an inner conductor (5), a coaxial discharge box (6), a plasma chamber (7), a dielectric insulator (8), a magnetic field generating means constituted by a permanent magnet (9), a magnetic path of a high magnetic permeability material (10), an acceleration electrode (11), an ion extraction electrode (13), an earth electrode (14), insulators (15, 16), and a sample gas lead-in pipe (17).

Koike's ion source is fundamentally different from the plasma torch claimed in claim 8, Koike's ion source does not have the cylindrical outside conductor and the cylindrical space between the outside conductor and the electric discharge tube. On the other hand, the plasma torch claimed in claim 8 has the cylindrical space between the cylindrical outside conductor and the electric discharge tube, the cylindrical space having a predetermined radial length and extending in an axial direction from the bottom face of the axial hole at an arbitrary length such that the cylindrical space does not reach the one end face of the outside conductor in order to match

transmission impedance. The transmission impedance matching is performed by matching a ratio between the diameters of the inner and outer conductors of the coaxial cable with the ratio between the outer diameter of the antenna and the inner diameter of the outside conductor.

A plasma torch disclosed in U.S. Patent No. 4,611,108 to Leprince, et al. is similar to the waveguide microwave plasma torch discussed as the prior art in the specification of the present application, and does not have the cylindrical space for matching transmission impedance of the claimed invention.

U.S. Patent No. 6,388,225 to Bluem, et al. discloses a plasma torch having a coaxial guide (2), an electrode (13) and a nozzle (22). An interior conductor (39) of the coaxial guide (2) is suspended electrically insulated in a disk (6) through an intermediate member (7). The intermediate member (7), the electrode (13) and the nozzle (22) form an antenna. In order to tune the microwave, the position of the interior conductor (39) in the coaxial guide (2) and its length are adjustable. The electrode (13) and the nozzle (25) project through a thermal insulator (11). Bluem's plasma torch is not provided with a cylindrical gap between an exterior conductor of the coaxial guide (2) and the thermal insulator (11). Bluem, et al. fails to disclose the cylindrical space between the electrical discharge tube and the outside conductor defined in the new claim 8.

U.S. Patent No. 5,221,427 to Koinuma, et al. discloses a plasma generator having a cylindrical insulator arranged between a cylindrical center conductor and a cylindrical conductor. According to Koinuma, et al., the center and outer conductors form electrodes and glow discharge plasma or corona discharge plasma is generated in a gap between the center conductor and the insulator. On this account, the center conductor, the insulator and the outer conductor extend in an axial direction at about the same length, respectively. In addition, a cylindrical gap between the insulator and the outer conductor opens on the lower face of the outer conductor. On the other hand,

according to the invention claimed in claim 8, the electric discharge tube extends downwardly beyond the tip of the antenna and the end face of the outside conductor, and the cylindrical space is formed between the outside conductor and the electric discharge tube, the cylindrical space having a predetermined radial length and extending downwardly at an arbitrary length such that the cylindrical space does not reach the one end face of the outside conductor in order to match transmission impedance. Thus, plasma is generated between the top of the antenna and the inside wall of the electric discharge tube. Namely, the plasma torch defined in claim 8 is clearly distinguished from Koinuma's plasma generator.

A glow discharge plasma generator disclosed in U.S. Patent No. 6,221,268 to Li, et al. is entirely different from the plasma torch defined in claim 8. Li's plasma generator does not have an electric discharge tube between an outside conductor and an antenna, or a cylindrical gap between the electric discharge tube and the outside conductor.

In view of the foregoing points, the present invention as claimed in claim 8 is considered to be new and also to be based on an inventive step. For this reason, claim 8 is deemed to be allowable. Claim 14 is dependent from claim 8 and is allowable at least for the reasons that claim 8 is allowable.

Wherefore, a favorable action is earnestly solicited.

Respectfully submitted,

KIRSCHSTEIN, ISRAEL, SCHIFFMILLER & PIERONI, P.C.
Attorneys for Applicant(s)
425 Fifth Avenue, 5th Floor
New York, New York 10016-2223
Tel: (212) 697-3750 Fax: (212) 949-1690

/Alan ISRAEL/

Alan Israel
Reg. No. 27,564